

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (currently amended) A control program testing method for testing a control program which is written in a certain programming language by use of an automatic code generation means generator which produces automatically a control program which is similar in contents with a control model indicating a control specification and written in the certain programming language from to perform the control model, with requisite control specifications thereof being written in a requisite control specifications writing language, the control program testing method comprising steps of:

producing operation results of a simulation means simulator which simulates operation of the control model and operation results of program execution means section which executes the control program, while making a relational linkage between ~~individual~~ each of corresponding operation results; and

testing presence or absence of abnormality in at least one of the control model and the control program with respect to each relational linkage;-

wherein said each relational linkage is made about similar contents between the control model and the control program based on correspondence information which indicates a correspondence relationship between the control model which is provided at automatic generation of the control program by the automatic code generator and the control program which is produced from the control model.

2. (canceled)

3. (currently amended) ~~A~~The control program testing method as in claim 21,
wherein the relational linkage is made for one of the control model and the control
program based on the setting of a break point which specifies a suspend point of operation and
for the other based on a setting of a corresponding break point based on the correspondence
information.

4. (currently amended) ~~A~~The control program testing method as in claim 3,
wherein the break point is adapted to set individually for functional blocks which
constitute the control model.

5. (currently amended) ~~A~~The control program testing method as in claim 21,
wherein output of operation results, with the relational linkage being made between the
individual corresponding operation results, is implemented based on the execution and suspend
of the control program, one line at a time, by the program execution ~~means~~section.

6. (currently amended) ~~A~~The control program testing method as in claim 21,
wherein the testing of the presence or absence of abnormality is implemented by
~~comparing means~~a comparator which compares successively between the operation results of the
~~simulation means~~simulator and the operation results of the program execution ~~means~~section in
relational linkage.

7. (currently amended) ~~A~~The control program testing method as in claim 6, wherein the successive comparison between the operation results of the ~~simulation~~
~~means~~simulator and the operation results of the program execution ~~means~~section by the ~~comparing means~~comparator is implemented in terms of comparison between simulation sequence of the control model and execution sequence of the control program based on the correspondence information.

8. (currently amended) ~~A~~The control program testing method as in claim 6, wherein the successive comparison between the operation results of the ~~simulation~~
~~means~~simulator and the operation results of the program execution ~~means~~section by the ~~comparing means~~comparator is implemented in terms of comparison between variable values which are calculated by the simulation of the control model and variable values which are calculated by the execution of the control program based on the correspondence information.

9. (currently amended) ~~A~~The control program testing method as in claim 8, wherein the testing of the presence or absence of abnormality by comparison between the variable values which are calculated by the simulation of the control model and the variable values which are calculated by the execution of the control program based on the correspondence information is implemented in terms of determination as to whether or not the difference between the variable values calculated by the simulation of the control model and the variable values calculated by the execution of the control program is within an allowable range.

10. (currently amended) A The control program testing method as in claim 6 further comprising the step of:

producing, in the event of determination of the presence of abnormality by the ~~comparing~~
~~means~~comparator, a simulation spot of the control model and the ~~an~~ execution spot of the control program at a time point of the determination as a result of the test.

11. (currently amended) A The control program testing method as in claim 1 further comprising the step of:

making alterable at least one of the variable values held at the ~~a~~ suspend point among the variable values calculated by the simulation of the control model and the variable values held at the suspend point among the variable values calculated by the execution of the control program when the simulation of the control model and the execution of the control program are suspended during the test.

12. (currently amended) A The control program testing method as in claim 1 further comprising the step of:

producing at least the operation results of the ~~simulation means~~simulator which simulates the operation of the control model and the operation result of the program execution ~~means~~ which executes the control program to a display ~~means~~ to display visually.

13. (currently amended) A control program testing apparatus for testing a control program which is written in a certain programming language by use of automatic code generation means which produces automatically a control program which is similar in contents

with a control model indicating a control specification and written in the certain programming language from to perform the control model, with requisite control specifications thereof being written in a requisite control specifications writing language, the control program testing apparatus comprising:

synchronizing means which produces operation results of simulation means which simulates operation of the control model and operation results of program execution means which executes the control program, while making a relational linkage between ~~individual~~each of corresponding operation results, the simulation means and the program execution means being operated concurrently; and

testing means for testing presence or absence of abnormality in at least one of the control model and the control program based on output operation results; with respect to each relational linkage;

wherein the synchronizing means makes said each relational linkage about similar contents between the control model and the control program based on correspondence information which indicates a correspondence relationship between the control model which is provided at automatic generation of the control program by the automatic code generation means and the control program which is produced from the control model.

14. (canceled)

15. (currently amended) ~~A~~The control program testing apparatus as in claim 13,
wherein the synchronizing means makes the relational linkage for one of the control model and the control program based on the setting of a break point which specifies a suspend

point of operation and for the other based on setting of a corresponding break point based on the correspondence information.

16. (currently amended) AThe control program testing apparatus as in claim 15, wherein the break point is set individually for functional blocks which constitute the control model and the synchronizing means causes simulation means and the program execution means operate in a synchronized manner.

17. (currently amended) AThe control program testing apparatus as in claim 13, wherein output of operation result by the synchronizing means is implemented based on the execution and suspend of the control program, one line at a time, by the program execution means and the synchronizing means causes simulation means and the program execution means operate in a synchronized manner.

18. (currently amended) AThe control program testing apparatus as in claim 13 further comprising:

comparing means which implements the testing of the presence or absence of abnormality by comparing successively between the operation results of the simulation means and the operation results of the program execution means in relational linkage.

19. (currently amended) AThe control program testing apparatus as in claim 18, wherein the successive comparison between the operation results of the simulation means and the operation results of the program execution means by the comparing means is

implemented in terms of comparison between ~~the~~a simulation sequence of the control model and ~~the~~an execution sequence of the control program based on the correspondence information.

20. (currently amended) ~~A~~The control program testing apparatus as in claim 18, wherein the successive comparison between the operation results of the simulation means and the operation results of the program execution means by the comparison means is implemented in terms of comparison between variable values which are calculated by the simulation of the control model and variable values which are calculated by the execution of the control program based on the correspondence information.

21. (currently amended) ~~A~~The control program testing apparatus as in claim 20, wherein the testing of the presence or absence of abnormality by comparison between variable values calculated by the simulation of the control model and variable values calculated by the execution of the control program based on the correspondence information is implemented in terms of determination as to whether or not the difference between the variable values calculated by the simulation of the control model and the variable values calculated by the execution of the control program is within an allowable range.

22. (currently amended) ~~A~~The control program testing apparatus as in claim 18 further comprising:

producing, in the event of determination of the presence of abnormality by the comparing means, ~~the~~a simulation spot of the control model and ~~the~~an execution spot of the control program at ~~the~~a time point of the determination as a result of the test.

23. (currently amended) ~~A~~The control program testing apparatus as in claim 13 further comprising:

making alterable at least one of the variable values held at ~~the~~a suspend point among the variable values calculated by the simulation of the control model and the variable values held at the suspend point among the variable values calculated by the execution of the control program when the simulation of the control model and the execution of the control program are suspended during the test.

24. (currently amended) ~~A~~The control program testing apparatus as in claim 13 further comprising:

display means which is adapted to display visually at least the operation results of the simulation means which simulates the operation of the control model and the operation result of the program execution means which executes the control program.

25. (currently amended) A computer readable medium tangibly storing therein a control program testing program which is used for testing a control program which is written in a certain programming language by use of ~~an~~ automatic code ~~generation means~~generator which produces automatically a control program which is similar in contents with a control model indicating a control specification and written in the certain programming language ~~from a to perform the~~ control model, with requisite control specifications thereof being written in a requisite control specifications writing language, the control program testing program, upon execution through a computer, performing steps comprising:

~~as means for execution through a computer for testing presence or absence of~~
abnormality in at least one of the control model and the control program;

~~means for generating, from information provided at automatic generation of the control~~
program, correspondence information which indicates ~~the~~a correspondence relationship between
the control model and the control program, and making a relational linkage between ~~a~~each of a
plurality of suspend points of operation of ~~simulation means~~a simulator which simulates the
control model and a corresponding one of a plurality of suspend points of operation of program
execution ~~means~~section which executes the control program based on the correspondence
information;

~~means for directing the simulation means~~simulator and the program execution
~~means~~section to proceed to the simulation and the program execution;

~~means for detecting a suspend of the simulation means~~simulator and a suspend of the
program execution ~~means~~section following the simulation and program execution; and

~~means for comparing the~~a simulation result of the control model and ~~the~~an execution
result of the control program upon detecting suspends of simulation and program execution, and
testing the presence or absence of abnormality based on the comparison result with respect to
each relational linkage;

wherein said each relational linkage is made about similar contents between the control
model and the control program based on correspondence information which indicates a
correspondence relationship between the control model which is provided at automatic
generation of the control program by the automatic code generator and the control program
which is produced from the control model.

26. (currently amended) AThe computer readable medium tangibly storing therein
control program testing program as in claim 25,

wherein the correspondence information includes execution position correspondence information which is information indicating the relationship between corresponding positions of the control model and the control program, and

wherein the ~~means for making~~ of a relational linkage of suspend points based on the correspondence information is that which sets, by being rendered the setting of a break point which specifies a suspend point of operation of one of the ~~simulation means~~ simulator and the program execution ~~means~~ section, a break point which specifies a corresponding spot of the other based on the execution position correspondence information.

27. (currently amended) AThe computer readable medium tangibly storing therein a
control program testing program as in claim 26,

wherein the ~~means for testing~~ of the presence or absence of abnormality based on the comparison result tests the presence or absence of abnormality by at least comparing one of the suspend points of simulation of the control model and one of the suspend points of execution of the control program based on the execution position correspondence information.

28. (currently amended) AThe computer readable medium tangibly storing therein a
control program testing program as in claim 25,

wherein the correspondence information includes variable correspondence information which indicates the a correspondence relationship between variable values pertaining to

processing of the control model and variable values pertaining to processing of the control program, and

wherein the ~~means for testing~~ of the presence or absence of abnormality based on the comparison result tests the presence or absence of abnormality by at least comparing the variable values calculated by the simulation of the control model and the variable values calculated by the execution of the control program based on the variable correspondence information.

29. (currently amended) A computer readable medium tangibly storing therein a control program testing program which is used for testing a control program which is written in a certain programming language by use of an automatic code generation means~~generator~~ which produces automatically a control program which is similar in contents with a control model indicating a control specification and written in the certain programming language ~~from~~ to perform the control model, with requisite control specifications thereof being written in a requisite control specifications writing language, the control program testing program being characterized by: upon execution through a computer, performing:

~~as means for execution through a computer for testing of presence or absence of abnormality in at least one of the control model and the control program;~~

~~means for generating, from information provided at automatic generation of the control program, correspondence information which indicates the~~ a correspondence relationship between the control model and the control program, and making a relational linkage between the each of a plurality of suspend points of operation of simulation ~~means~~ a simulator which simulates the control model and the a corresponding one of a plurality of suspend points of operation of program execution ~~means~~ section which executes the control program based on the

correspondence information, the testing of presence or absence of abnormality in at least one of the control model and the control program being made with respect to each relational linkage;

~~means for directing the simulation means~~simulator and the program execution
~~means~~section to proceed to the simulation and the program execution;

~~means for detecting a suspend of the simulation means~~simulator and a suspend of the
program execution ~~means~~section following the simulation and program execution; and

~~means for producing the~~a simulation result of the simulation means simulator and ~~the~~an
execution result of the program execution ~~means~~section upon detecting suspends of simulation
and program execution-;

wherein said each relational linkage is made about similar contents between the control
model and the control program based on correspondence information which indicates a
correspondence relationship between the control model which is provided at automatic
generation of the control program by the automatic code generator and the control program
which is produced from the control model.

30. (currently amended) AThe computer readable medium tangibly storing therein a
control program testing program as in claim 29,

wherein the ~~means for producing of the simulation result of the simulation~~
~~means~~simulator and the execution result of the program execution ~~means~~section comprises
~~means for producing the operation results to a display means~~to display visually.

31. (currently amended) AThe computer readable medium tangibly storing therein a
control program testing program as in claim 29,

wherein the correspondence information includes execution position correspondence information which is information indicating the relationship between corresponding positions of the control model and the control program, and

wherein the ~~means for making~~ of a relational linkage of suspend points based on the correspondence information is designed to set, by being rendered the setting of a break point which specifies a suspend point of operation of one of the ~~simulation means~~ simulator and the program execution ~~means~~ section, a break point which specifies a corresponding spot of the other based on the execution position correspondence information.